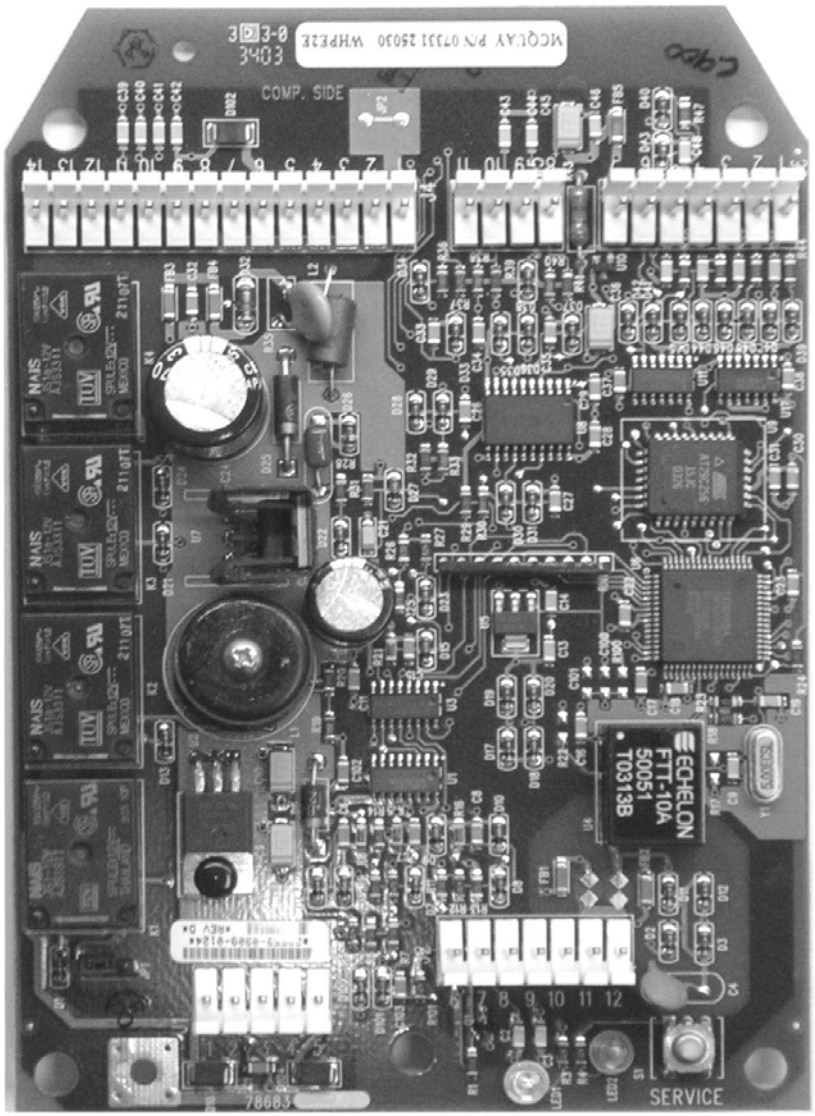
| Installation and Maintenance | IM 660-3 |
|---|---|
| | Group: **WSHP** |
| | Part Number: **106018961** |
| | Date: **May 2005** |

# MicroTech 2000™ Water Source Heat Pump Unit Controller



# Contents

# Introduction

This manual provides information about the MicroTech 2000™ Water Source Heat Pump (WSHP) controller and control system used in the McQuay International WSHP product lines. The manual describes the controller's components, input/output configurations, and service procedures.

For network installation or commissioning instructions for new projects, refer to the protocol information document ED 14954. For general information on a particular WSHP unit, refer to the model-specific installation manual (see Table 1).

***Table 1: Model-specific water source heat pump installation literature***

| Document number | WSHP unit model |
|---|---|
| IM 407 | Vertical WSHP (007 to 060) |
| IM 439 | Large Vertical WSHP (070 to 290) |
| IM 447 | Console Units WSHP |
| IM 494 | WMH/CWH (007 to 019) |
| IM 526 | Horizontal WSHP (007 to 120) |
| IM 544 | CCH/HWH (006 to 060)* |
| IM 656 | Horizontal WSHP (019 to 060) |
| IM 742 | Enfinity Horizontal WSHP (007 to 060) |
| IM 778 | Enfinity Vertical WSHP (007 to 060) |

*50 Hz only

**⚠ WARNING**

**Electric shock hazard.**
**Can cause equipment damage, personal injury, or death.**
Properly ground equipment. Connections and service to the MicroTech WSHP controller control panel must be performed only by personnel knowledgeable in the operation of the equipment being controlled.

**⚠ WARNING**

**Moisture in the control panel can cause personal injury and improper equipment operation.**
When servicing this equipment during rainy weather or high humidity conditions, protect the electrical components in the main control panel.

**⚠ CAUTION**

**Temperature hazard. Can cause damage to system components.**
The controller is designed to operate in ambient temperatures from 32°F to 140°F (O°C to 60°C), and in relative humidity up to 95% (noncondensing). The controller can be stored in ambient temperatures from 40°F to 176°F (40°C to 80°C), and in relative humidity up to 95% (noncondensing).

**⚠ CAUTION**

Properly commission (page 6) the water source heat pump before using for temporary heating or cooling. Failure to properly commission can cause equipment damage not covered by warranty.

**⚠ CAUTION**

**Static sensitive components. Static discharge while handling electronic circuit boards can cause damage to the components.**
Discharge any static electrical charge by touching the bare metal inside the main control panel before performing any service work. Never unplug cables, circuit board terminal blocks, relay modules, or power plugs while power is applied to the panel.

**⚠ CAUTION**

This equipment generates and uses radio frequency energy. If not installed and used in accordance with this manual, it can cause interference to radio communications. It has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. Operation is subject to the following conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users are required to correct the interference at their own expense. McQuay International disclaims any liability resulting from any interference or for the correction thereof.

# General Information

The MicroTech 2000™ WSHP unit controller provides control of McQuay and AAF water source heat pumps. The controller enables the mode of operation, monitors the water and air temperatures, and indicates fault conditions. Each unit controller is factory programmed, wired, and tested for effective operation of your McQuay WHSP.

The MicroTech 2000 WSHP controller uses LONWORKS® technology. One of the following two versions of the application software is loaded into the controller at the factory.

**LONMARK® 3.3 certified application code** is the current standard application code for MicroTech 2000 units. Use LONMARK application code in new applications including:

- Units that operate stand alone.
- Units that are integrated into a LONWORKS communication network for communicating with a building automation system (BAS) of your choice.

For network integration information, refer to the Protocol Information document ED 15054. Unit controllers with LONMARK application code have a software identification of WHPE2E or higher.

**LonTalk® application code** was designed prior to certification. Use this application software only in existing systems where an existing MicroTech Communications Gateway (MCG) or MicroTech Communications Gateway for Open Protocol (MCGOP) panel is installed. Use LonTalk application code in existing systems where:

- MicroTech 2000 WSHPs connect to a McQuay MicroTech monitor through a MicroTech Communication Gateway (MCG panel).
- MicroTech 2000 WSHPs connect to a third party BAS system through a MicroTech Communications Gateway for Open Protocol (MCGOP) panel.

If you choose to upgrade your heat pumps, the other application code can be installed in the field.

## Component Data

### *Microprocessor*

The MicroTech 2000 WSHP unit controller is a preprogrammed microprocessor containing the software required to monitor and control the unit. The controller supports a minimum of six analog inputs, four digital inputs and five digital outputs (including the LED). All electrical connections to the board are provided by three mass termination style headers. Two of the headers are designated strictly for factory wiring, the other for a field wiring harness that terminates to a screw-type terminal strip on the unit's exterior.

The controller uses set points and fixed preprogrammed parameters to maintain unit control (many of the set points and preprogrammed parameters can be adjusted with a PC over the network).

### *Yellow Status LED*

A yellow, on-board status LED aids in diagnostics by indicating the water source heat pump operating mode and alarm conditions. The yellow LED indicates the unit operating mode as shown in Table 2. For more information on alarms, refer to the "Alarm monitoring and control" section on page 10.

A remote status LED is provided with all optional wall-mounted temperature sensor packages. It has the same function as the on-board status LED. If used, the remote LED connects to the MicroTech WSHP controller at connection #1 on Terminal Board #1.

***Table 2: Status LED indication***

| Status LED status | Mode |
|---|---|
| On continually | Occupied, Occupied Load Shed |
| On 0.5 sec, Off 5.5 sec | Unoccupied |
| On 5.5 sec, Off 0.5 sec | Tenant Override, Override Load Shed |
| On 0.1 sec, Off 0.1 sec | Alarm Condition (Condensate Overflow, Brownout, Compressor Fault) |

### *Service Pin*

A service pin (button) is provided that can be used to cause the Neuron® chip to broadcast a message over the LONWORKS network containing its unique 48-bit Neuron ID. This ID is useful during network commissioning. For another method of forcing the controller to broadcast its Neuron ID, see "Tenant override" on page 5.

### *Red Service LED*

A red on-board service LED provides diagnostics by indicating the Neuron chip status. The red LED indicates the Neuron chip status as shown in Table 3 below.

***Table 3: Service LED indication***

| Service LED status | Mode |
|---|---|
| Off continually | (Normal) The Neuron has an application and is configured. |
| On continually | The Neuron does not have an application or is damaged. (Downloading an application may correct this.) |
| Blink slowly | The Neuron has an application but is unconfigured. |

### *Temperature Sensing*

The MicroTech 2000 WSHP unit controller uses negative temperature coefficient (NTC) thermistors for temperature sensing. A thermistor chart, which provides voltage-to-temperature and resistance-to-temperature conversion data, is included in Table 9 on page 12. The discharge air temperature sensor is located at the inlet to the fan. The leaving water temperature sensor is located in the leaving water line.

# Standard Control Features

Standard features of the MicroTech 2000 WSHP control include:

- Heating and cooling control from a room sensor
- Monitoring of all equipment protection controls
- Fan and compressor operation
- Monitoring of discharge air temperature
- Monitoring of leaving water temperature
- Status of all vital unit functions
- Optional control outputs

Additional standard features of the MicroTech 2000 control are provided below.

## Compressor Short Cycle Protection

When a compressor is energized, it remains energized for at least 2 minutes before the temperature control sequence is allowed to de-energize it. An alarm condition can override this "minimum-on" timer and stop the compressor if necessary. When a compressor is de-energized, it remains de-energized for at least 5 minutes before the temperature control sequence is allowed to energize it again.

## Random Start

The random start feature prevents simultaneous compressor startup that could otherwise occur after the following events:

- Unit powerup
- Unoccupied to occupied changeover
- Brownout condition

The compressor start delay can be from 5 to 37 seconds and is determined by the unique 48-bit Neuron chip ID.

## Delayed Reversing Valve De-energization

This feature is provided to delay "swishing." It prevents the reversing valve from returning to its normal (cooling) position for a period of approximately 10 seconds after the compressor is re-energized when the unit is in the heating mode. If necessary, an alarm condition can override the delay timer and de-energize the reversing valve with the compressor.

## Condensate Overflow Alarm

If a condensate overflow alarm is detected, the unit controller immediately disables the compressor. Once the overflow alarm disappears, the unit controller automatically resets the WSHP unit. The condensate overflow sensor is an exposed ring terminal located in the condensate drain pan. The condensate overflow alarm occurs only when the unit is in cooling mode.

## Brownout Alarm

The on-board brownout feature is meant to protect the compressor contactors from low voltage or "brownout" conditions. If the supply voltage to the water source heat pumps is below 82% of the nameplate value, the WSHP controller detects it, indicates it, and de-energizes the compressor. After rectifying the brownout condition (when supply voltage remains above 90% of nameplate) normal unit operation resumes.

## High Pressure Refrigerant Alarm

If excessive pressure in the refrigeration circuit is detected by the high pressure switch, the compressor and reversing valve de-energizes immediately. If the high pressure alarm disappears, manually reset the unit controller by disconnecting and reconnecting power to the unit.

## Low Temperature Refrigerant Alarm

Upon detection of a low temperature refrigerant alarm, the unit controller immediately puts the reversing valve in the cooling position for 60 seconds. After 60 seconds, the compressor is disabled. If the low temperature alarm disappears, manually reset the unit controller by disconnecting and reconnecting power to the unit. The low temperature alarm occurs only when the unit is in heating mode.

## Low Pressure Refrigerant Alarm

Upon detection of a low pressure refrigerant alarm, the unit controller immediately disables the compressor. If the low pressure alarm disappears, manually reset the unit controller by disconnecting and reconnecting power to the unit.

## Change Filter Notification (network units only)

When the water source heat pump fan run time exceeds a network-adjustable set point, a change filter notification is indicated locally and over the MicroTech network.

# Configurable Relay Outputs

The MicroTech 2000 WSHP controller provides one relay output that can be configured for the following four options:

- Boilerless system (skin heat) relay
- Motorized water valve relay
- Fresh air damper relay
- Timed output relay (LONWORKS only)

These options can affect installation requirements and unit control. If more than one configurable relay output option is required, the MicroTech 2000 WSHP auxiliary board is required to provide the other three outputs. The MicroTech 2000 WSHP auxiliary board typically is factory mounted only in 2-compressor-circuit WSHP units. Only three relay outputs are available for use as configurable relay outputs in 2-circuit WSHP units. All configurable relay outputs are set to "no function" by default and must be field configured. A description of the four relay options follows.

## Boilerless System/Auxiliary Heat Relay (LONWORKS only)

The relay receives loop water temperature input from the MicroTech Loop Water Controller through the gateway panel and provides relay output to electric heat on a call for heat after loop temperature falls.

## Boilerless System/Auxiliary Heat Relay (LONMARK only)

The relay output energizes when the space temperature reaches the heating set point and de-energizes when the space temperature exceeds the heating set point plus a configurable differential set point (defaulted to 3°F).

## Motorized Valve Relay

The relay provides output to the motorized valve to shut off water through the unit when the compressor is not operating.

## Fresh Air Damper Relay

The relay provides output to the open damper whenever the fan is operating in the occupied cycle.

## Timed Output Relay (LONWORKS only)

The relay provides output to an auxiliary load to control its operation based on a specific time schedule different from that of the heat pump unit.

***Figure 1: First control signal output***

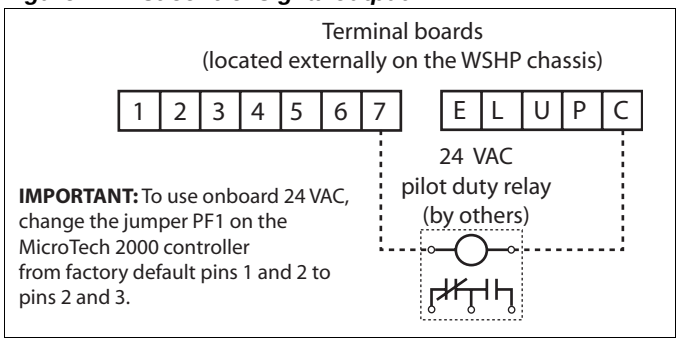



***Figure 2: Second control signal output***

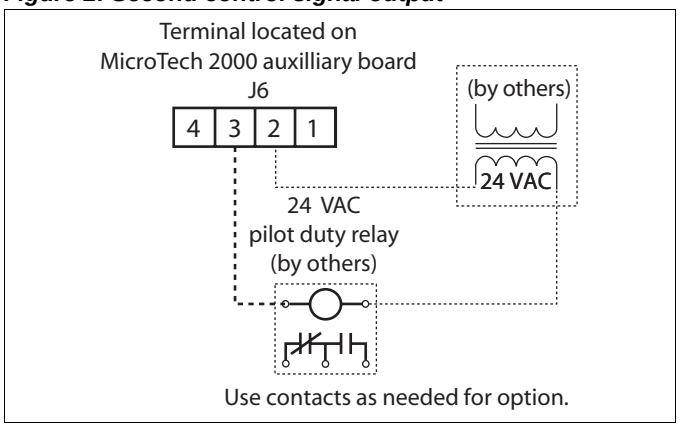



***Figure 3: Third control signal output***

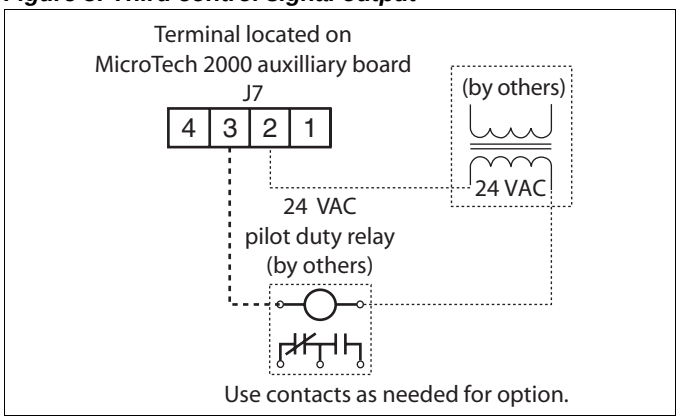
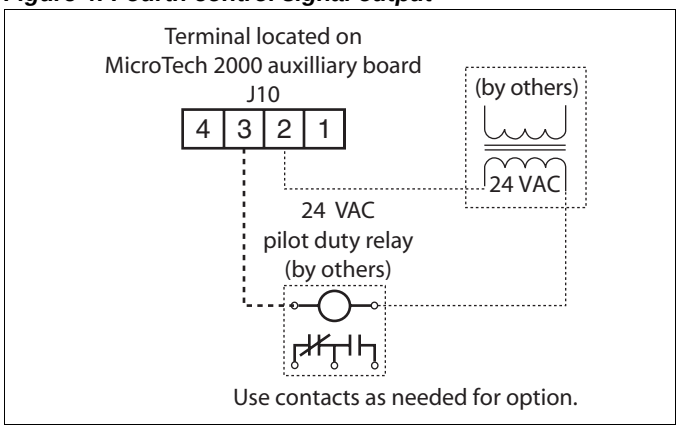



***Figure 4: Fourth control signal output***



# Interface Features

## MicroTech Network

Control sequencing, stop/start, equipment protection monitoring, and fault resets can be accomplished through a network connection. The following unique values and parameters can be accessed for each unit (refer to Protocol Document ED15054 for more information):

- Return air and discharge air temperatures
- Compressor, fan and reversing valve status
- High pressure, low temperature, brownout and drain pan status
- Occupied and unoccupied heat and cool set points
- Auto/manual and occupied/unoccupied fan control
- Mode, fault, system, schedule and set point operation
- Compressor starts and fan run hours
- Load shed level (LONWORKS only)
- Tenant override status

In addition, the following unique operation and maintenance parameters can display for each unit:

- Leaving water temperature
- Return air temperature set point (wall sensor adjustment)
- Adaptive optimal start (LONWORKS only)
- Occupied/unoccupied (on/cycle) fan mode
- Room temperature warning
- Filter changes from fan hours
- Compressor management: on/off differential, minimum off time, minimum on time

**Communications Failure (LONWORKS):** If the network communication link fails for any reason, the affected WSHP controller remains operational. Its operating mode will be the last received over the network unless power is cycled, and then it defaults to occupied. Its minimum position, heating, and cooling set points will be those last received over the network, regardless of whether power is cycled.

**Communications Failure (LONMARK):** If the network communication link fails for any reason, the affected WSHP controller remains operational. The status of its heating and cooling set points as well as its occupancy and other network adjustable settings depends upon whether the BAS is using LONWORKS bindings with associated heartbeats.

## Wall-Mounted Sensor

There are four optional wall sensor packages available. All include a remote status LED and tenant override button. Set point adjustment and thermometer are optional features.

The wall-mounted sensor must be field installed and field wired to the water source heat pump. Terminal Board #1 provides the connections for all room temperature sensor field wiring. Refer to the unit wiring diagram provided and to IM 529, MicroTech Room Temperature Sensors, for information on wall sensor package installation.

***Figure 5: Wall-mounted temp sensor wiring***

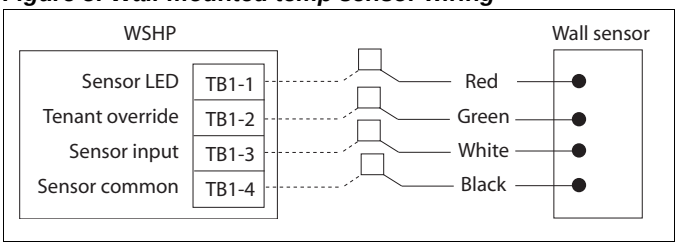



***Table 4: Maximum wire length to sensors***

| Gauge | Length (ft.) |
|---|---|
| 18 AWG | 625 |
| 20 AWG | 380 |
| 22 AWG | 260 |

## Remote Room Set Point Adjustment

The remote set point adjustment potentiometer allows the room set point to be adjusted up or down by as much as 3°F (1.7°C). It is available with several of the optional wall sensor packages.

## Tenant Override

A wall-mounted tenant override switch is standard on all McQuay MicroTech Room Temperature Sensors. Pressing and holding the tenant override button for 1.0 to 6.0 seconds puts the unit into tenant override mode for a set time period (default = 60 minutes). Press the tenant override button again for 1.0 to 6.0 seconds and the unit returns to unoccupied mode by default. A separate configuration property is available that allows users to extend the tenant override period for up to 60 minutes with a second button press. Except for the fact that it is temporary, the tenant override operating mode is identical to the occupied operating mode.

**LONWORKS only:** Pressing and holding the tenant override button for at least 6 seconds but not more than 10 seconds activates the network "query address" mode, indicating the unit address in question at the MicroTech gateway panel.

**LONWORKS only:** Pressing and holding the tenant override button more than 10 seconds activates the network "self-configure" mode, requesting the assignment of the next sequential address from the MicroTech gateway panel.

**LONMARK only:** Similar to pressing the service pin, pressing and holding the tenant override button for more than 10 seconds causes the Neuron chip to broadcast a message over the LONWORKS network containing its unique 48-bit Neuron ID. This is useful during network commissioning.

# Commissioning

The following commissioning procedures pertain to water source heat pumps equipped with the MicroTech Water Source Heat Pump Controller. These procedures must be performed in addition to the mechanical and electrical system commissioning procedures outlined in the model-specific installation literature (listing provided in Table 1 on page 1).

**⚠ WARNING**

Electrical Shock Hazard. Can cause severe injury or death. Failure to bond the frame of this equipment to the building electrical ground with the grounding terminal provided or other acceptable means can result in electrical shock. Service must be performed only by qualified personnel.

**⚠ CAUTION**

Before applying power to any unit, closely follow the pre-start procedures in the model-specific installation literature. See Table 1 on page 1.

## Pre-Start

### *Required tools and literature*

The following tools and additional literature may be required to properly commission a MicroTech 2000 Water Source Heat Pump Controller.

**Tools:**

- Digital voltmeter
- Digital ohmmeter
- Digital thermometer
- General technician's tools
- PC equipped with Monitor™ software (Network Water Source Heat Pumps only)

**Literature:**

- Model-specific water source heat pump installation bulletin (See Table 1 on page 1.)
- Program-specific sequence of operation bulletin
- MicroTech Monitor Program User's Manual (if PC is used)

### *Water Source Heat Pump Identification*

Although the water source heat pumps look similar, there are significant internal differences that are defined by the model number code string. In addition to the basic heating and cooling equipment, the model number code string specifies which factory-configured options are provided. These options determine the internal wiring configuration and the field wiring requirements.

It is extremely important to correctly locate each water source heat pump according to job requirements. The proper location should have been determined during the installation process. Nevertheless, verify proper location during the commissioning process.

### *Field Wiring Check*

A unit wiring diagram is provided with each unit, along with a model-specific Installation and Maintenance Guide. Before the commissioning process begins, refer to this literature and, using the following check lists, thoroughly check the electrical installation.

### *Wall Sensor Packages*

1. Check that the cable is twisted and shielded with drain wire (Belden 8729 or equivalent).
2. Check that four conductors are available.
3. Check that the conductors are terminated at the unit and at the wall sensor package to screw terminal board #1 in accordance with the field wiring diagram, on which terminals are clearly labeled. Terminal 4 is used for both the room sensor common and the shield wire.
4. Check the cable length between the wall sensor package and its water source heat pump controller. (See Table 4 on page 5.)

### *Network Communication Units*

1. Check that the cable is a twisted, unshielded pair of copper strand conductors.
2. Check that the conductors are terminated properly.
3. Check that the conductors are terminated at the MicroTech gateway panel according to the field wiring diagram supplied with the panel.

### *Set Points*

The Water Source Heat Pump set point values are held in memory and can be modified only over the MicroTech network. Initially, before any changes are made over the network, the WSHP uses the default factory set points shown in Table 5.

## Start-up

Following are WSHP start-up procedures for each communication type. The start-up procedure must be performed by a qualified technician for every WSHP on a job. Connections for network wiring are made at terminals 5 and 6 of Terminal Board #1. The FTT-10 (free topology transceiver) on the MicroTech WSHP 2000 Controller is polarity insensitive; thus polarity issues need not be addressed.

### *Procedure for WSHP*

1. Apply power to the unit. Turn the main power switch to ON.
2. Check the status LED and operating mode changeover devices. The status LED should illuminate 30 to 40 seconds after powerup. If a wall sensor package is used, the remote status LED should also illuminate.
3. Verify that the water source heat pump is operating according to its sequence of operation as outlined in the "Description of Operation" section on page 8.

***Table 5: Network WSHP default set points and adjustability***

| Description | Factory-programmed set point | Adjustability range |
|---|---|---|
| Occupied heating set point | 70°F (21°C) | 35°F to 120°F (1.7°C to 49°C) |
| Occupied cooling set point | 74°F (23°C) | 35°F to 120°F (1.7°C to 49°C) |
| Fan—occupied | On | On, cycle, heat, cycle/cool on |
| Unoccupied heating set point | 60°F (16°C) | 35°F to 120°F (1.7°C to 49°C) |
| Unoccupied cooling set point | 85°F (29°C) | 35°F to 120°F (1.7°C to 49°C) |
| Fan—unoccupied | Cycle | On, cycle |
| Tenant override—1st press | 1:00 | Off, 0:30 to 8:00 |
| Tenant override—2nd press | Off | Off, 0:30 to 8:00 |
| Differential | 2°F (1.2°C) | 1°F to 10°F (0.6°C to 5.6°C) |
| Auto/Manual | Auto | Manual (occupied, unoccupied, fan only, off) |
| Next filter change (hours) | 600 | 100 to 5000 |
| Clock schedule | 1 | Up to 32 |
| Load shed start level | Off | Off, 1 to 7 |
| Tenant set point adjustment | Off (0°F, 0°C) | Off, on (3°F to 1.7°C) |
| Low temperature warning | 55°F (13°C) | 35°F (1.7°C)—high not used |
| High temperature warning | 95°F (35°C) | 120°F (49°C)—low not used |

# Description of Operation

## Fan Operation

When the unit is in heating or cooling mode, the fan is on. When a compressor is running, the fan is on. In the unoccupied mode, if the fan unoccupied set point is on (not cycle) or if a compressor is running, the fan remains on. In the occupied mode, if the fan occupied set point is on (not cycle), the fan is always on. If the set point is heat cycle/cool on, the fan cycles with the compressor in heating and is on continuously in cooling.

## Unoccupied Operating Mode

The descriptions below assume that the factory default unoccupied fan setting is used and the fan cycles with the compressor. If the unoccupied fan setting is adjusted to ON, the fan runs continuously.

### *Cooling Operation*

The fan energizes and the reversing valve de-energizes when the space temperature rises to the UCS set point (see note below). If the reversing valve was previously energized, the compressor energizes after a 10-second delay. If the reversing valve does not change state, the compressor is energized immediately.

Once the compressor energizes, the start-to-stop (minimum) timer overrides normal temperature control and keeps it energized for at least 2 minutes (fixed.) The compressor de-energizes when the space temperature falls below the UCS set point (to a minimum temperature of UCS–DIFF).

The fan also de-energizes when the space temperature falls below the UCS set point; however, controller code prevents the fan from stopping until 12 seconds after the compressor stops.

**Note –** During normal (non-alarm) operation, the compressor is disabled if the stop-to-stop (minimum off) timer has not expired (5 minutes, fixed).

### *Heating Operation*

The fan and reversing valve energizes when the space temperature falls to the UHS set point (see note below). If the reversing valve was previously de-energized, a time delay of approximately 10 seconds must expire before the compressor energizes.

Once the compressor energizes, the start-to-stop (minimum on) timer overrides normal temperature and keeps it energized for at least 2 minutes (fixed). The compressor de-energizes when the space temperature rises above the UHS set point to a maximum temperature of USHS + DIFF).

The fan also de-energizes when the space temperature rises above the UHS set point; however, the controller code prevents the fan from stopping until 12 seconds after the compressor stops.

**Note –** During normal (non-alarm) operation, the compressor is disabled if the stop-to-stop (minimum off) timer has not expired (5 minutes, fixed).

## Occupied Operating Mode

The descriptions below assume that the factory default occupied fan setting is used and that the fan is always on. If the occupied fan setting is adjusted to CYCLE, the fan cycles with the compressor.

### *Cooling Operation*

The fan energizes and the reversing valve de-energizes when the space temperature rises to the OCS set point (see note below). If the reversing valve was previously energized, the compressor energizes after a 10-second delay. If the reversing valve does not change state, the compressor energizes immediately.

Once the compressor energizes, the start-to-stop (minimum) timer overrides normal temperature control and keeps it energized for at least 2 minutes (fixed.) The compressor de-energizes when the space temperature falls below the OCS set point (to a minimum temperature of OCS–DIFF).

The fan also de-energizes when the space temperature falls below the OCS set point; however, controller code prevents the fan from stopping until 12 seconds after the compressor stops.

**Note –** During normal (non-alarm) operation, the compressor is disabled if the stop-to-stop (minimum off) timer has not expired (5 minutes, fixed).

### *Heating Operation*

The reversing valve energizes when the space temperature falls to the OHS set point (see note below). If the reversing valve was previously de-energized, the compressor energizes after a 10-second delay.

Once the compressor energizes, the start-to-stop (minimum on) timer overrides normal temperature and keeps it energized for at least 2 minutes (fixed). The compressor is de-energized when the space temperature rises above the OHS set point to a maximum temperature of OSHS + DIFF).

The fan is also de-energized when the space temperature rises above the OHS set point; however, the controller code prevents the fan from stopping until 12 seconds after the compressor stops.

**Note –** During normal (non-alarm) operation, the compressor is disabled if the stop-to-stop (minimum off) timer has not expired (5 minutes, fixed).

## Holding Mode

If the unit comes out of the heating or cooling modes into the holding mode, the compressor de-energizes after the 2-minute timer expires. The unit must stay in the holding mode with the compressor off for 30 seconds before it is allowed to go into the heating or cooling states. During this time, the reversing valve is not allowed to switch states.

## Tenant Override Mode

A wall-mounted tenant override switch is available for use with all MicroTech 2000 WSHP unit controllers. Pressing and holding the tenant override button for 1.0 to 6.0 seconds puts the unit into tenant override mode for a set time period (default = 60 minutes). Press the tenant override button again for 1.0 to 6.0 seconds and the unit returns to unoccupied mode by default. A separate configuration property is available that allows users to extend the tenant override period up to 60 minutes with a second button press. Except for the fact that it is temporary, the Tenant Override operating mode is identical to the Occupied operating mode.

**LONWORKS only:** Pressing and holding the tenant override button for at least 6.0 seconds but not more than 10 seconds activates the network “query address” mode, indicating the unit address in question at the MicroTech gateway panel.

**LONWORKS only:** Pressing and holding the tenant override button more than 10 seconds activates the network “self-configure” mode, requesting the assignment of the next sequential address from the MicroTech gateway panel.

**LONMARK only:** Similar to pressing the service pin, pressing and holding the tenant override button for more than 10 seconds causes the Neuron chip to broadcast a message over the Lon network containing its unique 48-bit Neuron ID. This is useful during network commissioning.

## Load Shed Mode (LONWORKS only)

When the network load shed level is less than or equal to the load shed threshold setting in the unit, load shedding is activated. The amount the controller adjusts the set points depends upon the network threshold level and the step value.

## Optimal Start (LONWORKS only)

Whether heating or cooling, every start is an optimal start if the optimal start window is greater than zero. The unit controller optimal start logic examines past data to calculate the optimal time to change the heat pump from unoccupied to occupied operation. During optimal start, load shed and tenant override are ignored.

If this option is selected, two hours (adjustable) prior to scheduled time of occupancy, the unit begins calculating the time required to bring the space temperature to occupied set point. At the appropriate moment, the unit energizes and begins heating or cooling as necessary. The unit notes actual time to reach occupied set point and compares it to calculated time. If the difference exceeds 15 minutes, the unit adjusts its factors to adapt to actual room conditions.

## Faults

The WSHP controller examines fault conditions in the order of ascending priority. Higher priority faults do not override lower priority faults. A higher priority fault must be manually cleared before the WSHP controller can indicate a second, lower priority fault. If the unit has only one compressor, faults on the second circuit are ignored. For units with two compressors, second circuit faults are lower priority than first circuit faults. In a dual circuit unit, a second circuit fault indication does not disable the unit unless the first circuit also fails.

# Diagnostic Service

## Unit Identification (Wink) Command

The unit identification function allows verification of an individual unit network address without opening the unit access panels. The compressor shuts off during this period and the minimum off timer must expire before the compressor is allowed to run again.

Upon receiving a “wink” command from a network management node, the heat pump exhibits the following identification sequence (status LED and fan sequences occur simultaneously):

- Status LED: Flashes (on 0.5 sec, off 0.5 sec) for 15 seconds.
- Fan: The heat pump fan turns off for 5 seconds, turns on for 5 seconds, then off again for 5 seconds.

## Alarm Monitoring and Control

The water source heat pump controller is programmed to monitor the water source heat pump for specific alarm conditions that may occur on the various model types. If an alarm condition exists and is detected by the controller, a “fault” occurs. The water source heat pump controller indicates that a fault has occurred at the status LED (on-board or remote) and executes appropriate control actions for the alarm conditions.

During a fault condition, the status LED flashes constantly (on 0.1 second, off 0.1 second) until the fault is cleared. Refer to “Test Procedures” on page 12 of the “Service Information” section for information on troubleshooting digital input faults.

## Clearing Faults

Before any fault can be cleared, the alarm conditions that caused it must have returned to normal. When the alarm conditions are gone, a fault may be cleared either automatically or manually, as follows.

- An auto reset fault immediately clears whenever the alarm conditions that caused it disappear.
- To clear a manual reset fault, cycle power to the controller.

**Note –** Investigate and eliminate the cause of a manual reset fault before placing the unit back into service.

## Alarm Fault Descriptions

Table 6 below describes the alarm faults, how they are triggered, the factory settings that trigger them and how they are reset. A detailed discussion of each follows.

***Table 6: Alarm and fault code summary***

| Fault | Trigger | Factory setting | Fault reset (Clear) |
|---|---|---|---|
| High pressure | Hardware | Opens at 395 ± 10 psig<br>Closes at 250 ± 25 psig | Manual |
| Low pressure | Hardware | Opens at 7 ± 3 psig<br>Closes at 22 ± 7 psig | Manual |
| Condensate overflow | Hardware | Conductivity trip point: 2.5 micro ohms | Manual |
| Brownout | Software | Line voltage ± 82%of nameplate voltage | Auto |

### *High Pressure Fault*

The “High Pressure” fault indicates that the high pressure switch input (J4-9) sensed an open circuit while the controller was calling for the compressor to run.

The high pressure switch (HP) is wired in series with the compressor relay output (J4-5) and the compressor relay coil. Therefore, if a high pressure condition occurs, the switch immediately shuts down the compressor; then unit operation is disabled by the WSHP controller software. For information on troubleshooting digital input faults, see “Test Procedures” on page 12.

**Effects (as applicable):**

- The compressor immediately de-energizes.
- The software disables normal unit operation until the fault condition is manually corrected.

### *Low Temperature Fault*

The “Low Temperature” fault indicates that the low temperature switch input (J4-12) sensed an open circuit while the controller was calling for the compressor to run.

The low temperature switch opens when the temperature falls below its set point (model and size dependent). For information on troubleshooting digital input faults, see “Test Procedures” on page 12.

**Effects:**

- Unit changes to cooling for 60 seconds for coil defrost.
- After 60 seconds in cooling, the software immediately de-energizes the compressor and fan.
- The software disables normal unit operation until the fault condition is manually corrected.

### *Low Pressure Faults*

The “Low Pressure” fault indicates that the low pressure switch input (J4-11) sensed an open circuit while the controller was calling for the compressor to run. The low pressure switch opens when the temperature falls below its set point. For information on troubleshooting digital input faults, see “Test Procedures” on page 12.

**Effects:**

- The compressor immediately de-energizes.
- The software disables normal unit operation until the fault condition is manually corrected.

### *Condensate Overflow Fault*

The “Condensate Overflow” fault indicates that the condensate overflow sensor (J4-14) sensed a grounded signal while the controller was calling for the compressor to run. For information on troubleshooting analog input faults, see “Test Procedures” on page 12.

**Effects:**

- The compressor immediately de-energizes.
- The software disables normal unit operation until the fault condition is manually corrected.

### *Brownout Fault*

The “Brownout” fault indicates the water source heat pump is sensing low voltage levels. It is designed to protect the compressor and contactors from low line voltage or “brownout” conditions.

The controller is programmed with a brownout set point that corresponds to 82% of the water source heat pump’s nameplate line voltage value. If the water source heat pump controller senses a voltage level less than its set point for more than 1 second, it triggers the brownout fault. The fault resets automatically when the sensed voltage remains at or above a level corresponding to 90% of the nameplate value for a period of 1 second. For information on troubleshooting this alarm, see “Test Procedures” on page 12.

**Effects (as applicable):**

- The compressor immediately de-energizes.

## Change Filter Notification (network units only)

The “Change Filter” notification indicates that the fan has operated longer than the set number of hours. Typically, this warning is used to alert the building operator to replace the filter. To clear the notification, reset the filter timer at the network PC.

**Effect:**

- An alarm message identifying the water source heat pump network address and time of occurrence is sent to the network printer.

## Inputs and Outputs

### *Analog Inputs*

The MicroTech WSHP unit controller has six standard analog inputs. See Table 7. The controller can sense temperatures in the range of 0° to 158°F (–18° to 70°C).

***Table 7: Analog inputs***

| Description | Location |
|---|---|
| Discharge air temp sensor | Inlet to fan |
| Leaving water temp sensor | Leaving water line |
| Condensate overflow sensor | Condensate drain pan |
| Brownout (supply voltage) sensor | On board |
| Room air temp sensor | Remote basic wall sensor |
| Tenant override/set point adjust | Remote wall sensor |

### Digital Inputs

The water source heat pump controller has four standard digital inputs. See Table 8. Digital input conditioning includes RC filtering with a time constant of at least 4.7 milliseconds. The base module provides additional filtering using software filtering techniques.

The digital inputs sense the presence or absence of an external 24 VAC ± 20% power source with a minimum of 10 mA AC current flowing through the following isolated contacts:

***Table 8: Digital inputs***

| Description | Location |
|---|---|
| Refrigerant high pressure—N/C | HP switch |
| Refrigerant low pressure—N/C | LP switch |
| Refrigerant low temp—N/C | LT switch |
| Remote start/stop—N/O | Remote switch |

Refer to the wiring diagram supplied with your unit for specific wiring details.

### *Digital Outputs*

All digital outputs, with the exception of the on-board and off-board status LEDs, are capable of controlling electromechanical or solid state relays. They switch inductive loads at 24 VAC ± 20%, 0.4 pF and at the steady state AC RMS currents listed in Table 9 (10x single cycle surge currents are assumed on initial turn on). The on-board and off-board status LEDs are controlled by one of the Neuron's I/0 pins capable of PuIse Width Modulation.

***Table 9: Digital outputs***

| Description | Type/AC RMS current rating |
|---|---|
| Fan contactor | E/M pilot duty relay at 300 mA-AC (SPST N/O contacts) |
| Compressor contactor | E/M pilot duty relay at 300 mA-AC (SPST N/O contacts) |
| Reversing valve solenoid | E/M pilot duty relay or SS random turn on Triac at 600 mA-AC (SPST N/O contacts) |
| On-board status LED<br>Off-board status LED | Yellow<br>DC-sourced signal—current limited to 10 mA-DC |
| Multi-purpose (spare) isolated E/M contacts | E/M pilot duty relay at 300 mA-AC (SPST N/O contacts) |

### *Input/Output Tables*

All WSHP controller input and output connections and their corresponding water source heat pump components are shown in Table 10 on page 14.

## Test Procedures

### *Microprocessor Problems*

The status LED indications can aid in WSHP controller diagnostics. Approximately 40 seconds after power is applied to the WSHP, the status LED should illuminate as shown in Table 2 on page 2. If not, either there is a software problem or the WSHP controller is defective.

### *Power Supply Problems*

The WSHP controller requires a 24 VAC power supply. It is connected to the board at the section labeled 24V GND and 24 VAC (terminals J41 and J42). Refer to the unit wiring diagram. If you suspect a problem with the WSHP controller power, check the following:

1. Verify that the main power switch is at ON.
2. Check the voltage at the secondary of the transformer. It should be approximately 24 VAC (load dependent).

### Erroneous Temperature Readings

If you suspect that the WSHP controller is operating using erroneous temperature data, check the sensors using the following procedure:

1. Measure the temperature at the suspect sensor using an accurate thermometer.
2. Determine the sensor's analog input number. Refer to the unit wiring diagram or to the input/output tables (Table 10).
3. Remove the connector from its WSHP controller terminals and measure the resistance of the sensor (through the sensor connections).
4. Using the thermistor chart (Table 11), compare this value to the measured temperature.
5. If the measured resistance and temperature match, the WSHP controller may require factory service, or it may be defective.
6. If the measured resistance and temperature do not match, either there is a wiring problem or the sensor is defective. Check the wiring connection and the sensor circuit wiring for defects.

### Digital Input Faults

A digital input fault usually is caused by high-pressure, low-pressure or low-temperature alarm conditions resulting from mechanical problems in the water source heat pump. It also can be caused by a problem in the digital input circuit.

Below is a procedure to use to check for problems in the digital input circuit. If the probable cause of the fault is found using this procedure, attempt to clear the fault by cycling power to the WSHP. If the probable cause of the fault is not found using this procedure, assume that mechanical problems exist and have a qualified technician service the unit before attempting to reset the WSHP Controller.

1. Check the voltage at the secondary of transformer; it should be approximately 24 VAC.
2. Determine the switch's digital input number. Refer to the unit wiring diagram or to the input/output tables (Table 10).
3. Check the wiring and connections throughout the digital input circuit.
4. Measure the resistance through the switch contacts (with at least one wire disconnected). The switches normally are closed.

### Brownout Fault

The WSHP controller senses the AC voltage at the power input section terminals J41 and J42 (see unit wiring diagram). If the voltage at these terminals is less than 19.68 VAC for at least 1 second, the brownout fault occurs. The fault automatically clears if the voltage at the terminals remains greater than 21.6 VAC for at least 1 second.

If a brownout fault occurs, check the line voltage to the water source heat pump. If it is less than 82% of the nameplate value, contact the power company. If the line voltage remains greater than 90% of the nameplate value for more than 1 second but the fault does not reset, perform the following procedure:

1. Measure the voltage between terminals J41 and J42 on the WSHP controller.
2. If the voltage is low or fluctuates around 19.68 VAC, the WSHP controller is functioning properly. Go on to step 2.
3. If the voltage remains above 21.6 VAC for 1 second but the fault does not reset, the WSHP controller is defective.
4. Check the primary and secondary voltages of the power supply transformers.
5. Check for faulty wiring or connections throughout the power supply circuit.

### WSHP Controller Replacement

Data relating to the water source heat pump controller configuration and characteristics are stored at the factory when each unit is built and tested. If a WSHP controller is defective and must be replaced, its unit-specific software (defined by the above data) must be loaded into the replacement controller at the factory. To do this, the factory needs the following information:

- Full model number
- Serial number
- Date code for time of manufacture
- Software version of code loaded in the controller

The unit model and serial numbers are listed on the unit dataplate. The date code and software version of code are printed on the MicroTech unit controller adhesive-backed label. This information must be included with the replacement WSHP controller part order.

*Table 10: Inputs and outputs for WSHP units*

| Connection | Component description |
|---|---|
| J1-1 / TB#2-E | Remote digital source |
| J1-2 / TB#2-L | Remote digital signal |
| J1-3 / TB#2-U | Spare relay normally closed |
| J1-4/TB#2-P | Spare relay common |
| J1-5 / TB#2-C | Spare relay normally open |
| J2-6 / TB#1-1 | Room sensor LED |
| J2--7 / TB#1-2 | Tenant override |
| J2-8 / TB#1-3 | Room sensor input |
| J2-9 / TB#1-4 | Room sensor common |
| J2-10 / TB#1-5 | LonTalk connection |
| J2-11 /TB#1-6 | LonTalk connection |
| J2-12 / TB#1-7 | 24 VAC common |
| J41 | 24 V ground |
| J4-2 | 24 VAC |
| J4-3 | Fan relay output |
| J4-4 | Fan relay common |
| J4-5 | Compressor contactor output |
| J4-6 | Compressor contactor common |
| J4-7 | Reversing valve solenoid output |
| J4-8 | Reversing valve solenoid common |
| J4-9 | High pressure switch signal |
| J4-10 | Low pressure switch source |
| J4-11 | Low pressure switch signal |
| J4-12 | Low temperature switch signal |
| J4-13 | Low temperature switch source |
| J4-14 | Condensate overflow sensor |
| J5-8 | Leaving water temperature sensor input |
| J5-9 | Leaving water temperature sensor common |
| J5-10 | Discharge air temperature sensor input |
| J5-11 | Discharge air temperature sensor common |
| J6-1-7 | Auxiliary module connections |

*Table 11: Thermistor chart*

| °C | 10 k ohm | °F | °C | 10 k ohm | °F |
|---|---|---|---|---|---|
| 18 | 8.654 | 0 | 28 | 0.8777 | 82 |
| 17 | 8.173 | 1 | 29 | 0.8408 | 84 |
| 16 | 7.722 | 3 | 30 | 0.8056 | 86 |
| 15 | 7.298 | 5 | 31 | 0.7721 | 88 |
| 14 | 6.900 | 7 | 32 | 0.7402 | 90 |
| 13 | 6.526 | 9 | 33 | 0.7098 | 91 |
| 12 | 6.175 | 10 | 34 | 0.6808 | 93 |
| 11 | 5.845 | 12 | 35 | 0.6531 | 95 |
| 10 | 5.534 | 14 | 36 | 0.6267 | 97 |
| 9 | 5.242 | 16 | 37 | 0.6015 | 99 |
| 8 | 4.967 | 18 | 38 | 0.5774 | 100 |
| 7 | 4.708 | 19 | 39 | 0.5545 | 102 |
| 6 | 4.464 | 21 | 40 | 0.5326 | 104 |
| 5 | 4.234 | 23 | 41 | 0.5116 | 106 |
| 4 | 4.017 | 25 | 42 | 0.4916 | 108 |
| 3 | 3.812 | 27 | 43 | 0.4725 | 109 |
| 2 | 3.620 | 28 | 44 | 0.4543 | 111 |
| 1 | 3.438 | 30 | 45 | 0.4368 | 113 |
| 0 | 3.266 | 32 | 46 | 0.4201 | 115 |
| 1 | 3.104 | 34 | 47 | 0.4041 | 117 |
| 2 | 2.951 | 36 | 48 | 0.3888 | 118 |
| 3 | 2.806 | 37 | 49 | 0.3742 | 120 |
| 4 | 2.669 | 39 | 50 | 0.3602 | 122 |
| 5 | 2.540 | 41 | 51 | 0.3468 | 124 |
| 6 | 2.418 | 43 | 52 | 0.3340 | 126 |
| 7 | 2.302 | 45 | 53 | 0.3217 | 127 |
| 8 | 2.192 | 46 | 54 | 0.3099 | 129 |
| 9 | 2.089 | 48 | 55 | 0.2987 | 131 |
| 10 | 1.990 | 50 | 56 | 0.2878 | 133 |
| 11 | 1.897 | 52 | 57 | 0.2775 | 135 |
| 12 | 1.809 | 54 | 58 | 0.2675 | 136 |
| 13 | 1.726 | 55 | 59 | 0.2580 | 138 |
| 14 | 1.647 | 57 | 60 | 0.2489 | 140 |
| 15 | 1.571 | 59 | 61 | 0.2401 | 142 |
| 16 | 1.500 | 61 | 62 | 0.2317 | 144 |
| 17 | 1.432 | 63 | 63 | 0.2236 | 145 |
| 18 | 1.368 | 64 | 64 | 0.2158 | 147 |
| 19 | 1.307 | 66 | 65 | 0.2084 | 149 |
| 20 | 1.249 | 68 | 66 | 0.2012 | 151 |
| 21 | 1.194 | 70 | 67 | 0.1944 | 153 |
| 22 | 1.142 | 72 | 68 | 0.1878 | 154 |
| 23 | 1.092 | 73 | 69 | 0.1814 | 156 |
| 24 | 1.045 | 75 | 70 | 0.1753 | 158 |
| 25 | 1.000 | 77 | 71 | 0.1695 | 160 |
| 26 | 0.9572 | 79 | 72 | 0.1638 | 162 |
| 27 | 0.9165 | 81 | 73 | 0.1584 | 163 |

**McQuay Training and Development**

Now that you have made an investment in modern, efficient McQuay equipment, its care should be a high priority. For training information on all McQuay HVAC products, please visit us at www.mcquay.com and click on training, or call 540-248-9646 and ask for the Training Department.

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to www.mcquay.com.

McQuay®
Air Conditioning

 05/05